HYDRAZINE

Hydrazine is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 302-01-2 H_2NNH_2

Molecular Formula: H_4N_2

Hydrazine is a colorless, oily, fuming, liquid with a fishy odor. It is miscible with water and ethanol and slightly miscible with hydrocarbons and halogenated hydrocarbons. Hydrazine may explode when exposed to heat, flame, or upon chemical reaction with alkali metals. Combustion of hydrazine is highly exothermic. When heated to decomposition, it emits toxic nitrogen compounds (NTP, 1991).

Physical Properties of Hydrazine

Synonyms: hydrazine anhydrous; diamide; hydrazine base

Molecular Weight:	32.05
Boiling Point:	113.5 °C
Melting Point:	2 °C
Flash Point:	52 °C (126 °F)
Vapor Density:	1.1 (air = 1)
Density/Specific Gravity:	1.0036 at 25/4 °C (water = 1)
Vapor Pressure:	14.4 mm Hg at 25 °C
Conversion Factor:	1 ppm = 1.31 mg/m^3

(HSDB, 1991; Merck, 1989; Sax, 1989; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Hydrazine is used as a reducing agent for many transition metals and some nonmetals (arsenic, selenium, and tellurium) and uranium and plutonium. Other uses include as a corrosion inhibitor in boiler feedwater and reactor cooling water, in wastewater treatment, in electrolytic plating of metals on glass and plastics, in nuclear fuel reprocessing, as a rocket propellent, and as a scavenger for gases. Hydrazine has been detected in cigarette smoke (NTP, 1994a).

The primary stationary sources that have reported emissions of hydrazine in California are primary metal product manufacturers, manufacturers of guided missiles, space vehicles, and parts, and national security facilities (ARB, 1997b).

B. Emissions

The total emissions of hydrazine from stationary sources in California are estimated to be at least 1,800 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Hydrazine has been found to be a primary product of nitrogen fixation by Azotobacter algae (HSDB, 1991).

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of hydrazine.

INDOOR SOURCES AND CONCENTRATIONS

No information about the indoor sources and concentrations of hydrazine was found in the readily-available literature.

ATMOSPHERIC PERSISTENCE

The important chemical loss processes for hydrazine in the atmosphere are by reaction with the hydroxyl (OH) radical and with ozone (O_3). The calculated half-life and lifetime of hydrazine due to reaction with the OH radical are 3.7 hours and 5.3 hours, respectively. The calculated lifetime and half-life of hydrazine due to reaction with O_3 are 13 hours and 9 hours, respectively. Clearly, the overall half-life and overall lifetime of hydrazine in the atmosphere are a few hours (Atkinson, 1995). Its reaction products include NH_3 and N_2 (Kao, 1994).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics "Hot Spots" Program (AB 2588). Of the risk assessments reviewed as of April 1996, hydrazine represented the principal cancer risk in 1 of the approximately 550 risk assessments reporting a total cancer risk equal to or greater than 1 in 1 million, and contributed to the total cancer risk in 4 of these risk assessments. Hydrazine also contributed to the total cancer risk in 1 of the approximately 130 risk assessments reporting a total cancer risk equal to or greater than 10 in 1 million (OEHHA, 1996a). For non-cancer health effects, hydrazine did not contribute to the total hazard index in any of the risk assessments reporting a total chronic or acute hazard index greater than 1 (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to hydrazine are inhalation, ingestion, and dermal contact.

Non-Cancer: Hydrazine is extremely irritating to the eyes and respiratory tract, highly hepatotoxic, and a hemolytic agent. Acute exposure to high levels of hydrazine may also produce severe central nervous system, kidney, and liver effects in humans. Symptoms include headache, dizziness, pulmonary edema, seizures, and coma in humans. The liquid is corrosive and may produce chemical burns and severe dermatitis from skin contact (U.S. EPA, 1994a).

A chronic non-cancer Reference Exposure Level (REL) of 0.24 micrograms per cubic meter ($\mu g/m^3$) is listed for hydrazine in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered for chronic toxicity are the respiratory system and skin (CAPCOA, 1993). The United States Environmental Protection Agency (U.S. EPA) has not established a Reference Concentration (RfC) or an oral Reference Dose (RfD) for hydrazine (U.S. EPA, 1994a).

No information on adverse reproductive function effects on humans is available. Fetotoxicity has been observed in rodents exposed to hydrazine by injection (U.S. EPA, 1994a).

Cancer: Adequate information on the carcinogenic effects of hydrazine in humans is not available. There is evidence that animals exposed to hydrazine by inhalation, ingestion, and injection showed increased incidences of tumors. The U.S. EPA has classified hydrazine in Group B2: Probable human carcinogen. The U.S. EPA calculated an inhalation unit risk estimate of 4.9×10^{-3} (microgram per cubic meter)$^{-1}$. The U.S. EPA estimates that if an individual were to breathe air containing hydrazine at 2×10^{-4} $\mu g/m^3$ over an entire lifetime, that person would theoretically have no more than a 1 in 1 million increased chance of developing cancer (U.S. EPA, 1994a). The International Agency for Research on Cancer has classified hydrazine in Group 2B: Possible human carcinogen based on sufficient evidence in animals and inadequate evidence in humans (IARC, 1987a).

The State of California has determined under Proposition 65 that hydrazine is a carcinogen (CCR, 1996). The inhalation potency factor that has been used as a basis for regulatory action in California is 4.9×10^{-3} (microgram per cubic meter)$^{-1}$ (OEHHA, 1994). In other words, the potential excess cancer risk for a person exposed over a lifetime to 1 $\mu g/m^3$ of hydrazine is estimated to be no greater than 4,900 in 1 million. The oral potency factor that has been used as a basis for regulatory action in California is 17 (milligram per kilogram per day)$^{-1}$ (OEHHA, 1994).